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# Added worker effect revisited through the French working time reduction experiment

Abstract

This paper studies the impact of the French working time reduction experiment on the family labour supply. I expanded on the conventional added worker effect in order to analyse successively the effect of the "35 hours" on two dimensions of the spouse's labour supply: the probability to participate in the labour market and the working hours. Econometric tests are carried out on 10 000 couples drawn from the French EMPLOI survey of the INSEE. In the first estimation using Heckman's and Cogan's fixed costs frameworks, I found that working time reduction reduces the spouse's working hours when he (she) works. In the second one, using a multivariate probit analysis, I found that it increases the spouse's probability to join the labour force when he (she) was outside of the labour market in the previous period.

Key words : Family labour supply, added worker effect, working time reduction, fixed costs, Simultaneous equations, multivariate probit.

JEL-Code: J 22, C 35.

L'impact des 35 heures sur l'offre de travail familiale : Une analyse économétrique sur données françaises

Résumé

Cet article, qui s'inscrit dans la lignée des travaux sur l'effet d'un travailleur additionnel, étudie l'évolution de l'offre de travail familiale consécutive à la diffusion des 35 heures en s'appuyant sur un échantillon original de plus de 10 000 couples issu de l'enquête EMPLOI 2000. Deux dimensions de l'offre de travail de l'individu sont étudiées successivement lorsque son conjoint est affecté par la réduction du temps de travail : l'intensité de la participation au marché du travail et la décision de passer du statut d'inactif à celui d'actif.

Mots clés : Offre de travail familiale, Effet d'un travailleur additionnel, Réduction du temps de travail, Coûts fixes, Modèles d'équations simultanées, Probit multivariée

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# 1 Introduction

The term "added worker effect" usually refers to the temporary increase in the labour supply of married women whose husband has become unemployed. While the added worker effect is easily explained by theoretical models of family labour supply, empirical work has failed to reach a consensus regarding its magnitude, or even its existence (Heckman and MaCurdy [1980][1982], Lundberg [1985], Maloney [1991], Speltzer [1997]).

As Lundberg [1985] pointed out, in a model of family labour supply, the added worker effect could be applied to non working population, unemployed and employed individuals as well. When family earnings fall as a result of partner's unemployment the income effect modify the individual's reservation wage and influence the individual to increase his labour supply. The reservation wage is also influenced by the degree of complementary or substitution of leisure time between household members. Finally the one's labour supply increases when spouse's increasing nonemployed time provides a substitute for home production. Then, the spouse's labour supply responses come from the income and substitution effects.

The added worker effect is mainly studied when unemployment hits one member of the household, generally the husband. First, I expanded on the conventional added worker effect in order to analyse successively the effect of spouse's working time reduction on two dimensions of the partner's labour supply: the hours worked and the probability to participate in the labour market. Econometric tests are carried out on 10 000 couples drawn from the French EMPLOI survey of the National Statistic Institute (INSEE). In the first estimation using Heckman's framework and Cogan's fixed costs framework, I found that working time reduction reduces the spouse's working hours when she works. In the second one, using multivariate probit framework, I found that it increases the spouse's probability to enter in the labour worker when she was outside of the labour market in the previous period. First of all, Mincer [1962] preliminary work pointed out that a transitory layoff has a stronger effect on the spouse's labour supply than a permanent one. Therefore, a great number of econometric tests was carried out to estimate the magnitude of added worker effect associated with unemployment (Heckman and MaCurdy [1982], Lundberg [1985] [1988]).

Moreover, complementary studies estimated the worker added effect when other kinds of shocks affect the spouse's professional situation. Berger and Fleisher [1984] studied the impact of the modification husband's health on

the married woman's labour supply. Haurin [1989], and Johnson and Skinner [1986] analysed the impact of individual divorce and disease on the spouse's working hours.

The aim of this paper is to expand on the conventional added worker effect in order to analyse the influence of working time reduction on the partner's labour supply. Since 1996, French governments have adopted various incentive measures to stimulate the reduction of working time in firms, with the view of creating new jobs. A rebate in social contributions has been awarded to firms that reduced their working time. The law of January 19th 2000, called "Aubry's law" Minister's name who initiated it, generalised the working time reduction (WTR) by fixing the legal weekly working time at 35 hours. In the French Labour legislation, this threshold does not correspond to the maximum weekly working time but it is used to determine employee's overtime. Every working hours up to 35 hours should be paid from 25 % to 50 % more than the agreed hourly wage. Moreover, firms have the possibility to figure out employee's overtime on a weekly base or the yearly basis. They can also counterpart overtime monetary or in kind (attribution of extra free days).

The present generalisation of the 35 hours working week does not affect only firms and full time employees. It can also influence individuals who are not directly concerned with the WTR, such as part-time employees, as well as unemployed and people out of the labour market. Indeed, within a family labour supply framework, when the 35 hours process affects its spouse, the individual's reservation wage will be changed. The increase of the nonemployed spouse's time can be used for domestic production and encourage the other spouse to increase his (her) employed working time. This substitution effect implies an intra-family reallocation of time between domestic production, parental activities and leisure. Estrade, Meda and Orain [2001] stressed that although working time reduction slightly modified the distribution of domestic tasks between man and woman, it increased significantly the domestic production of those having reduced their employed working time. According to them, this increase varies between 6 % and 20 %. The nonemployed working times between spouses then tend to be substituable .

Moreover, in 2 cases out of 5, the working time reduction affects negatively the worker's global income (CGP [2001]). This income effect generates a fall in household wealth, which stimulates the reduction of all its members' consumption and leisure. Many studies focused on the family income effect

(Mroz [1987], Lundberg [1985]), none of them related to working time reduction. However, these studies seem to confirm the existence of a positive and significant relationship between the agent's wage and his spouse's working time.

As far as we know, the paper of Hunt [1998] is the only study on the added worker effect when the spouse is affected by a reduction of his working time. Using a 1984 to 1994 German panel of more than 3000 individuals she found, a very weak significant added worker effect. Besides she found a negative relationship between wife's working hours and the husband working time reduction.

To study the added worker effect related to the 35 hours French legislation, a sample of 10000 couples is drawn from the EMPLOI 2000 survey of the Economic and Statistic National Institute (INSEE). I analysed successively two dimensions of the response of the spouse's labour supply. Firstly, using Heckman's model and Cogan's fixed costs model, I tested the impact of one's working time reduction on his (her) spouse's working hours. Secondly, using multivariate probit framework, I analysed the spouse's probability to participate in the labour market.

The section 2 describes the data and presents descriptive statistics of the added worker effect. Section 3 deals with the two methodological frameworks used in this paper. Section 4 presents and comments the estimation results. Section 5 concludes.

# 2 The data

The French National Statistic Institute (INSEE) makes the French EMPLOYMENT survey every year. A sample of 10 525 couples in which at least one of the spouse is a full time employee is built from the year 2000 EMPLOYMENT survey through housing identification.

Information relating to the individual's working time deals exclusively with his "usual weekly working time". The distribution of this usual working time in our sample has clearly a tri-modal schedules. The great majority of the individuals either does not work (17 %), or work 35 hours (19 %) or work 39 hours (33 %). This concentration around these three peaks is weaker for men than for women. This difference is of course related to the strong proportion of women in part-time jobs. Nearly 15 % of women work less than 30 hours against 8 % for men.

Using the employee's usual working time as a proxy of the 35 hours process is not really convenient because this information does not reveal the situation of his firm regarding to the WTR. It is impossible to know if the worker's firm has signed an agreement of working time reduction or if himself has reduced his working time to 35 hours. Then the previous sample is matched with the administrative survey (URSSAF). The latter is an exhaustive file, which indexes all French firms according to the existence of an agreement of WTR or of the implementation of the 35 hours.

Thus, two kinds of information are available, which allow us to know if an employee works in a "35 hour firm": the situation of his firm with regards to the WTR, and his declaration of his usual weekly working time.

In the sample more than 2 out of 3 spouses full time employees weekly work either 35 or 39 hours. The proportion of full time employees with a usual weekly working time at 35 hours is higher in 35 hour firms than in the others (38 % against 11 %). However, a significant share of full time employees declares a usual weekly working time of 39 hours, despite their firm being a 35 hour one (32%). These paradoxical cases include in fact various situations: either these full time employees are not included in the 35 hours firms agreement, or they are still working 39 hours per week but in fact they work 35 hours per year due to new paid free days.

To take into account these different situations, new dichotomous variables are built by crossing the declaration by the full time employee of his usual weekly working time with the situation of his firm with regards to the 35 hours. When the full time employee declares a usual weekly working hours inferior or equal to 35 hours, the variable H35 equals 1 and 0 otherwise. When his firm is a 35 hour firm, the variable WTR equals 1, and 0 otherwise. Then NWTR35 equals 1 if H35=1 and WTR=0, NWRT39 equals 1 if H39=1 and WTR=0, WTR35 equals 1 if H35=1 and WTR=1 and finally WRT39 equals 1 if H35=0 and WTR=1.

Finally, the variables of the model are standardized. The weekly working hours are divided by 50, the logarithm of the hourly wage is obtained by dividing the monthly income by the weekly working time (taking into account the standardization of this variable) multiplied by 4,33 so that the wages and the working time are on the same basis, the age of the agent is divided by 100 and the level of education by 3.

| | Total | WTR | H35 | WTR35 |
|---|---|---|---|---|
| Total | **10525** | **3621** | **2650** | **1652** |
| Labour force situation at t | | | | |
| *Employed* | 70,7% | 71,5% | 71,25% | 71,0% |
| *Unemployed* | 8,2% | 8,0% | 8,7% | 8,5% |
| *Not in the labour force* | 21,1% | 20,5% | 20,8% | 20,5% |
| Spouse's working time | | | | |
| Mean weekly hours (std) | 33,24 (151,70) | 33,20 (146,94) | 32,97 (146,84) | 32,77 (147,21) |
| Spouse's labour force transition | | | | |
| *Not in the labour force at t-1* | **2171** | **722** | **521** | **327** |
| *In the labour force at t* | 15,9% | 18,3% | 18,9%* | 21,9%** |
| *Unemployed at t-1* | **964** | **322** | **258** | **153** |
| *Employed at t* | 39,4% | 3 6,1% | 37,9% | 31,55% |

** at 5%, at * 10% of significance

Table 1: *Individual's Labour Force and Transition between 1999 and 2000*

# 3 Estimates of the added worker effect

Table 1 provides the statistical results concerning the impact of working time reduction on family labour supply. Statistical tests show that only the added worker effect seems to be positive at the 5% of significance. Indeed the decision to enter in the labour market is more frequent among individuals whose full time employed spouse declares usually working 35 hours in a 35 hour firm (WTR35=1). This effect remains positive and significant.

On the other hand, the variable WTR35 affects negatively but not significantly the spouse's weekly working hours.

This first result seems to show the existence of an added worker effect related to working time reduction in a simple descriptive statistics. However, the couples for whom WRT35=1 have specific individual and familial characteristics. First, the household full time employees work in bigger firms, have a lower wage and rarely get executive status. Second, these households more rarely live in the Paris area and they less frequently have children. The labour supply literature outlines that these different characteristics affect strongly the number of working hours supplied. The aim of the following econometric tests is then to control these elements in order to check if the added worker

effect is still significant. Two kinds of estimations are successively carried out.

- Firstly, I analyse the impact of the variable WTR35, which is related to the spouse, on the intensity of the individual's participation on the labour market. The aim of this point is to determine if the volume of hours offered significantly depends on the situation of the spouse with regard to the 35 hours.

- Secondly, using lagged information available in the EMPLOYMENT survey I analyse the added worker effect. The aim is to determine if the individual's probability to become a participant in the labour market when he was previously inactive is linked to the situation of the spouse with regards to 35 hours.

Theoretically, the professional choice of the individual results from the programme of maximization of the utility function, $U(.)$ :

$$\begin{array}{ll} MaxU(l, C, X) & \\ s.c. & C = W(T - l) + R \\ & l \leq T \end{array}$$

where $T$ is the total time available, $h = (T - l)$ is the working time, $X$ is the individual's specific characteristics, $W$ is the hourly wages and $C$ is the consumption. In an individual labour supply framework, $R$ corresponds to the non wage income. In a family labour supply framework, it can also include the spouse's income. It can also include in a collective labour supply model, the sharing rule.

Disregarding inequality constraint $l \leq T$, the solution of this program makes it possible to obtain the labour supply function in the following reduced form:

$$h^* = h(W, R, X) \tag{1}$$

The working hours and the decision to join the labour market are the following:

$$\begin{array}{lll} h = 0 & \text{si} & h^*(W, R, X) \leq 0 \\ h = h^*(.) & \text{si} & h^*(W, R, X) > 0 \end{array}$$

Let's introduce $y_1 = 1$ if the individual's decision to participate in the labour market and $y_1 = 0$ otherwise.

A possible solution to estimate the equation of working hours would be to use Heckman's labour supply model. However, such a model suppose a linear relation between the decision to join the labour market and the amount of worked hours. Cogan [1981] and Blank [1988] stressed that theoretically this assumption is too restrictive and empirically not robust. Indeed, the observed working hours include additional fixed costs related to the worker's decision to join the labour market. Cogan's [1981] and Blank's [1988] works stated that the fixed costs associated to the decision to join the labour market represent nearly 30 % of the individuals' average annual wage. The lack of this dimension over-estimate the impact of the wages on the working hours.

Then the first estimations analyzing the relation between one's spouse's situation with regard to the 35 hours and the one's hours offered are successively carried out using Heckman's model and Cogan's fixed costs model.

## 3.1 Heckman's labour supply model

Based on a Tobit type 3 model, Heckman's model takes into account that the wage ($W$) and the working hours ($h$) can be observed only for employed workers and that $W$ and $h$ are jointly determined. This model deals with left censured data and correlated equations (Heckman [1979], Amémiya [1984]). The augmented hours equation and the logarithm wage equation, $N(W)$, are assumed to take the following form:

$$h^* = \gamma_1 + \gamma_2 Z_1 + \gamma_3 Z_2 + \gamma_4 N(W) + v_1 \quad \text{where} \quad v_1 \sim N\left(0, \sigma_1^2\right) \quad (2)$$

$$N(W) = \alpha_1 + \alpha_2 Z_1 + \alpha_3 Z_3 + v_2 \quad \text{where} \quad v_2 \sim N\left(0, \sigma_2^2\right) \quad (3)$$

After various experimentations I hold the following exogenous variables :

$Z_1$ is a vector of individual's characteristics including variables $SEX$, $AGE$, $AGE^2$, the level of education ($EDUC, EDUC^2$) and a variable crossing age and level of education ($AGE * EDUC$)

$Z_2$ is the specific hour equation individual' characteristics including the number of children ($CHILD0$,$CHILD1, CHILD2, CHILD3$) and the age of the youngest in the household ($YOUNGCHILD1, YOUNGCHILD2, YOUNGCHILD3$)

$Z_3$ is the specific wage equation individual' characteristics including the unemployment rate per sex and per department ($UR$) and the household's geographical localisation ($PARIS$).

From equations (2) and (3), the reduced form of augmented hours equation may be written as:

$$h^* = a_0 + a_1 Z_1 + a_2 Z_2 + a_3 Z_3 + u_1 \tag{4}$$

or more compactly, as:

$$h^* = \Delta_1 + u_1 \tag{5}$$

where

$$\begin{array}{l} a_0 = \gamma_1 + \gamma_4\alpha_1,\ a_1 = \gamma_2 + \gamma_4\alpha_2,\ a_2 = \gamma_3,\ a_3 = \gamma_4\alpha_3 \\ u_1 = v_1 + \gamma_4 v_2 \text{ and } u_1 \sim N(0, \sigma^2) \\ \text{where } \sigma^2 = \sigma_1^2 + \gamma_4^2\sigma_2^2 - 2\gamma_4\sigma_{12} \text{ and } \sigma_{12} = cov(v_1, v_2) \end{array}$$

In Heckman's model, the individual participates on the labour market when the reservation wage is less than the market wage or when the augmented hours are positive. The participation on the labour market $y_1$ is :

$$y_1 = \begin{cases} 1 & \text{if} \quad \frac{u_1}{\sigma} > \frac{\Delta_1}{\sigma} \\ 0 & \text{otherwise} \end{cases}$$

Reservation hours cannot be observed for any individual in the data and hours and wage offered cannot be observed for nonworkers. Without these data , an alternative statistical approach, such as maxmum likelihood is required to estimate the parameters. In such a case, the model is :

$$\begin{array}{ll} \left.\begin{array}{l} h^* = \gamma_1 + \gamma_2 Z_1 + \gamma_3 Z_2 + \gamma_4 N(W) + v_1 \\ N(W) = \alpha_1 + \alpha_2 Z_1 + \alpha_3 Z_3 + v_2 \end{array}\right\} & \text{if} \quad y_1 = 1 \\ N(W) = h^* = 0 & \text{if} \quad y_1 = 0 \\ (v_1, v_2) \sim NB(0, \Sigma_1) & \end{array}$$

where $\Sigma_1 = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_1^2 \end{pmatrix}$

Then likelihood function, if takes the following form :

$$L = \prod_{y_1=0} \left(1 - \Phi\left(\frac{\Delta_1}{\sigma}\right)\right) \prod_{y_1=1} f_2\left(v_1, v_2\right)$$

where $f_2\left(v_1, v_2\right)$ is a joint density of $v_1$ et $v_2$ and $\Phi$ is the cumulative density function.

## 3.2 Fixed costs labour supply model

Heckman' model assumes a linear relation between the decision to join the labour market and the amount of worked hours. Cogan's fixed costs model stated that this assumption is not relevant when worker incurred costs of labor force participation (Cogan [1981]). In such a case, the labour supply function is discontinuous. The individuals will not be willing to work below a minimum number of hours, termed reservation hours. The original Cogan's model included two kinds of fixed costs: money costs and time costs. Cogan stated that this second kind of cost does not affect in a significant way the labour supply function. Then they are not retained in this paper.

The reservation hours equation assumes the form:

$$h^r = \beta_1 + \beta_2 Z_1 + \beta_3 Z_2 + v_3 \quad \text{where} \quad v_3 \sim N\left(0, \sigma_3^2\right) \tag{6}$$

Equations (2), (3) and (6) imply a reservation wage equation of the form :

$$w^r = \frac{\beta_1 - \gamma_1}{\gamma_4} + \frac{\beta_2 - \gamma_2}{\gamma_4} Z_1 + \frac{\beta_3 - \gamma_3}{\gamma_4} Z_2 + \frac{v_3 - v_1}{\gamma_4} \tag{7}$$

Then, the decision to join the labour supply in a fixed costs model is the following:

$$y_1 = \begin{cases} 1 & \text{if} \quad y_1^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

where

$$y_1^* = h^* - h^r = \Delta_2 + u_2 \quad \text{and} \quad u_2 \sim N\left(0, \sigma_{u_2}\right)$$

and

$$\Delta_2 = (\gamma_1 + \gamma_4\alpha_1 - \beta_1) + (\gamma_2 - \beta_2) Z_1 + (\gamma_3 + \gamma_4\alpha_2 - \beta_3) Z_2 + \gamma_4\alpha_3 Z_3$$
$$\sigma_{u_2} = \sigma_1^2 + \gamma_4^2\sigma_2^2 + \sigma_3^2 + 2\gamma_4\sigma_{23} - 2\gamma_4\sigma_{12} + 2\sigma_{13}$$

Assuming an increasing labour supply, we observe workers when augmented hours are higher than reservation hours $h^* > h^r$. Then, using equation (8) the likelihood of observing a nonparticipant is simply :

$$P(y_1^* \leq 0) = \Phi\left(-\frac{\Delta_2}{\sigma_{u_2}}\right)$$

The appropriate density measure for observed hours and wages among the workers is:

$$\int_{-\infty}^{\frac{\Delta_2}{\sigma_{u_2}}} f_3\left(h - \gamma Z_2 - \gamma_4 N(W), N(W) - \alpha_1 Z_1, v_3\right) dv_3$$

where $f_3\left(h - \gamma Z_2 - \gamma_4 N(W), N(W) - \alpha_1 Z_1, v_3\right)$ is a trivariate normal density function. The normal function properties allow us to reduce the trivariate normal density function with the product of the bivariate conditional normal and unit normal marginal densities. The likelihood is then:

$$L = \prod_{y_1 \leq 0}\left(1 - \Phi\left(\frac{b_1 Z_1 + b_2 Z_2}{\sigma_{u_2}}\right)\right)$$
$$\prod_{y_1 > 0} \Phi\left(\frac{b_1 Z_1 + b_2 Z_2}{\sigma_{u_2}} | v_1, v_2\right) f_2\left(h - \gamma Z_2 - \gamma_4 N(W), N(W) - \alpha_1 Z_1\right)$$

## 3.3 Using professional lagged information

The aim is to determine if the is linked to the situation of the spouse with regards to 35 hours. This section analyses the individual's probability to become a participant in the labour market when he was previously in the non working population with regards to spouse's 35 hours situation. This second dimension of the added worker effect used professional lagged information available in the EMPLOYMENT survey. The decision process to join the labour market between 1999 and 2000 may be written as:

$$y_{i1} = \begin{cases} 1 & \text{if} \quad y_1^* \geq 0 \\ 0 & \text{otherwise} \end{cases} \tag{9}$$

where

$$\begin{array}{l} y_1^* = a_0 + a_1 \left( WTR35, WTR39, NWTR35 \right) + a_2 X + a_3 SLW + \epsilon_1 \\ y_1^* = Z_1 + \epsilon_1 \quad \text{where} \quad \epsilon_1 \sim N\left(0, 1\right) \end{array} \tag{10}$$

$X$ is the individual explanatory variables, $SLW$ is the spouse's logarithm wage and $WTR35, WTR39$ and $NWTR35$ are dummy variables on the spouse's situation regarding working time reduction.

To control for unobserved individual's propensity to work I expand this simple univariate probit model in two ways.

Firstly by introducing a variable explaining the decision to be out of the working population in the previous period. In this probit with sample selection the decision to joint the labour market is observed only if the individual was in the non working population in the previous period.

Secondly by using a system of equations where the individual's decision to participate in the labour market, the spouse's firm situation regarding working time reduction and the spouse's working time declaration are endogenous variables with possible correlation. Then, I use a trivariate probit model.

# 4 Results

Let us present successively the result concerning the two dimension of the added worker effect analysed in this paper. Firstly the impact of one's working time reduction on his (her) spouse's working hours. Secondly, the impact of one's working time reduction on the spouse's probability to join the labour force when his (her) was in the non working population in the previous period.

- Table 1.2. presents the results obtained in the first estimations analysing the impact of the variable WTR35, which is related to the spouse, on the intensity of the individual's participation on the labour market. Columns 2 and 3 present the results obtain by Heckman's model for wage and hours equations. Results of fixed costs model are presented in columns 4 and 5.

The last column deals with the reservation hours deducted from the equation of participation (equation 8), from the equation of wages (equation 3) and from the equation of the hours worked (equation 4). The significance of the coefficients of this last column is deducted from the variance of the coefficients calculated by assuming that covariances between the terms of error $v_1$, $v_2$ and $v_3$ are null.

- All in all, both selected specifications to study the impact of one's working time reduction to 35 hours seem to show that such a change modify in a significant way one's work supply. Fixed costs being considered does not affect the associated coefficient sign obtained in the Heckman's model but modifies their significance and their scale. The coefficient associated with Mill's ratio is positive both in the equations of wage and work supply. It is significant only in the wage equation. Thus employees' hourly reservation wage is higher than those of non working people.

- According to Heckman's model: individuals whose spouse is employed in a 35 hour firm, the spouse actually declaring that he (she) works 35 hours a week ($WTR35$) realizes less working hours. On the other hand, when one's spouses remains at 39 hours a week, even though their firm signed a WTR agreement ($WTR39$), one tends to work more.

- The fixed costs taken into account change slightly these results. Although the coefficient signs associated to variables $WTR35$ and $WTR39$ remains the same, the latter does not influence in such a significant way one's working time. Interpretation of the coefficient associated to the variable $WTR39$ is not obvious because this variable includes a wide range of situations. Employees may be whether completely excluded from the WTR process although their firm is a 35 hour one, or they may benefit from the working time reduction by being granted additional days off over the year. So their actual annual working time remains unspecified.

- Concerning the effect of variable $WTR35$, we obtained a similar result to Hunt's one [1998] on German data : spouse's working time reduction tends to reduce one's working time.

- Fixed costs being estimated, it appears that the reservation hours on which an individual is willing to join the labour market are lower when his or her spouse works in a 35 hour firm. Such a change thus encourages the individual to accept an employment of shorter weekly duration.

Table 1.2 : Parameter estimates of Hours and wage functions

| | Heckman's model | | Fixed cost model | | |
|---|---|---|---|---|---|
| | Hours of work function (1) | Wage function (2) | Hours of work MCO (3) | Wage function (4) | Reservation Hours functions (5) |
| Variable | Coefficient STD | | Coefficient STD | | |
| WTR35 | -0.039 | | -0.018 | | -0.0175 |
| | (0.006***) | | (0.008***) | | (0.082***) |
| WTR39 | 0.035 | | 0.008 | | -0.041 |
| | (0.0005***) | | (0.007) | | (0.076***) |
| NWTR35 | -0.005 | | -0.014 | | 0.005 |
| | (0.007) | | (0.009) | | (0.101) |
| NWTR39 (Réf.) | - | | - | | -. |
| LWP | -0.091 | | -0.107 | | 0.485 |
| | (0.006***) | | (0.023***) | | (0.091***) |
| WAGE | 1.682 | | 0.445 | | |
| | (0.047***) | | (0.076***) | | |
| Sexe | -0.012 | 0.564 | -0.036 | 0.210 | -0.153 |
| | (0.013) | (0.012***) | (0.019*) | (0.012***) | (0.012***) |
| Age | 0.907 | 6.447 | 0.373 | 2.862 | -42.570 |
| | (0.380***) | (0.623***) | (0.598***) | (0.380***) | (18.713.***) |
| Age² | -1.221 | -6.591 | -0.388 | -2.864 | -49.688 |
| | (0.441***) | (0.701***) | (0.689***) | (0.441***) | (27.294) |
| Educ | 1.812 | -0.944 | 0.442 | -0.226 | -3.211 |
| | (0.042***) | (0.073***) | (0.089***) | (0.042***) | (0.232***) |
| Educ² | -0.669 | -0.561 | -0.155 | 0.183 | 0.387 |
| | (0.014***) | (0.016***) | (0.024***) | (0.014***) | (0.014***) |
| age*educ | -2.100 | 2.334 | -0.538 | 0.727 | 2.795 |
| | (0.074***) | (0.118***) | (0.131***) | (0.129***) | (0.658***) |
| ENFANT0 (Réf.) | - | | - | | - |
| CHILDREN1 | -0.111 | | -0.027 | | 0.128 |
| | (0.006***) | | (0.008***) | | (0.088***) |
| CHILDREN2 | -0.245 | | -0.050 | | 0.377 |
| | (0.006***) | | (0.010***) | | (0.095***) |
| CHILDREN3 | -0.435 | | -0.072 | | 1.919 |
| | (0.009***) | | (0.025***) | | (0.119***) |
| CHILDYOUNG1 | -0.110 | | -0.040 | | 0.294 |
| | (0.009***) | | (0.011***) | | (0.029***) |
| CHILDYOUNG2 | -0.201 | | -0.092 | | 1.834 |
| | (0.011***) | | (0.028***) | | (0.133***) |
| CHILDYOUNG3 | -0.703 | | -0.223 | | 3.339 |
| | (0.016***) | | (0.006***) | | (0.188***) |
| Paris area | | 0.351 | | 0.120 | |
| | | (0.011***) | | (0.012***) | |
| UR | | -1.163 | | 6.966 | |
| | | (0.130***) | | (0.154***) | |
| Constant | -8.743 | 19.372 | -1.922 | 19.372 | 3.922 |
| | (0.336***) | (0.147***) | (0.459***) | (0.147***) | (0.218***) |
| Rho/Mill | -0.593*** | | 0.109*** | | |
| $R^2$ | 0.08 | 0.28 | 0.07 | 0.31 | |

Table 1.3.: Elasticity of the labour supply

| | Tobit bivarié | Coûts fixes |
|---|---|---|
| Compensated labour supply wage elasticity | 2.65 | 0.80 |
| Non wage income labour supply elasticity | -0.14 | -0.16 |
| Non-compensated labour supply wage elasticity | 2.54 | 0.67 |

- Concerning the wages equation, usual relations between the age and the level of education are obtained. The variable level of education influences negatively the wages but the variable crossing level of education and age increases the wage. Concerning the geographical location and the unemployment rate per department and per sex, the coefficients obtained are significant and conform to the formulated assumptions. Individuals working in Paris area have higher wage than the employees of the other metropolitan areas. Moreover, if we consider the rate of unemployment as a proxy variable worker's bargaining power, a fall of this power negatively affects the hourly wage obtained.

- Concerning the impact over the reservation hours , it appears that those are less significant when the spouse works 35 hours. This effect is strongly significant. Thus, within a fixed costs framework, the spouse's situation regarding the 35 hours affects both the hours actually worked and the hours of reserve. When one's spouse works in a 35 hour firm, the individual tends to work less hours and accepts more often employment of shorter duration.

- According to the specification retained for the equation of work supply (equation 4), it is easy to obtain the slope of the function of work supply compensated ($\bar{H}$) starting from the equation of Slutsky:

$$\frac{\partial \bar{H}}{\partial W} = \frac{\partial H}{\partial W} - H\frac{\partial H}{\partial R}$$

- Table 1.3 presents the elasticities of demand of work supply compared to the wages and the out of work income. The latter is -0.16 in Heckman's model and -0.14 in fixed costs model. According to both specifications, work is a normal good, its consumption grows with the income. First elasticities compared to the wages, according to the model selected, give very different results. Being given that the studied individuals are mainly women (86%), the elasticity of not-compensated labour supply estimated for the model with fixed costs (0.67 and 0.80) is not too far away from the estimates carried out by other studies (see Blundell and MaCurdy [1999] for a synthesis). Second,

the model not taking account of the fixed costs gives an evaluation of an unusually high elasticity. This result advocates to take into account the fixed costs.

Using both Heckman's model and fixed costs model $WTR35$, $WTR39$ and $NWTR35$ do not affect the individual's decision to join the labour market. However, this result does not allow us to conclude on the absence the added worker effect since it does not take account of the previous individual's professional situation.

- Table 1.4. presents the estimations carried out when these dimensions are taken into account. Columns 2 to 3 show the results of the probit model by taking account or not the impact of the rate of unemployment and using or not the spouse's wages. Column 4 presents a probit model controlling for the possible bias of selection coming from the study of the non working individuals during the previous period. This bivariate model allows us to retain a possible correlation between the individual's passed and present professional situation. Lastly, column 5 presents a trivariate probit model analyzing simultaneously the decision to join the working population, the spouse's declaration concerning the 35 hours and his firm situation regarding to the WTR. Whatever the specification selected, the added worker effect is positive and significant. Individuals are more likely to join the working population when their spouse works 35 hours in 35 hour firm. The significance of the coefficients is calculated using the White's [1981] heteroscedasticity correction.

Controlling the presence of a possible correlation between the probability of being out of the working population during the previous period and the probability of entering the labour market. Wald's test carried on let us reject the assumption according to which the independence between both equation at 1% of significance. So there is a positive and significant relation between both professional situations. However, this correlation being taken into account does not affect the sign of coefficients obtained with the previous univariate probit model.

In the trivariate probit model Wald's tests carried on led us to reject the assumption according to which the decision to join the labour market (on a threshold of 5%) depends on the situation of one's firm toward WTR. On the other hand, the other coefficients of correlation are not different in a significant way from 0. The sign and the significance of these coefficient figured out for this last specification are very closed to those obtained with the univariate probit model.

table 1.4 : Added worker estimations

| Variables | Univariate Probit Coefficient (std) | | | Bivariate Probit Coefficient (std) | Trivariate Probit Coefficient (std) |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (7) |
| WTR35 | 0,297 (0.096***) | 0,297 (0.096***) | 0,308 (0.096***) | 0,232 (0.090***) | 0,656 (0.275***) |
| WTR39 | 0,037 (0.098) | 0,039 (0.098) | 0,034 (0.098) | 0,033 (0.077) | 0,321 (0.238) |
| NWTR35 | -0,016 (0.131) | -0,017 (0.130) | -0,011 (0.130) | -0.007 (0.101) | 0.002 (0.475) |
| NWTR39 (Ref.) | - | - | - | - | - |
| SLW (direct) | -0,213 (0.104***) | -0.210 (0.104***) | - | -0.166 (0.088*) | -0,253 (0.113***) |
| SLW (VI) | | | -0.221 (0.115**) | | |
| Sex | 0,297 (0.219) | 0,297 (0.219) | 0.321 (0.211) | -0,273 (0.235) | 0,297 (0.114) |
| Age | 17.247 (11.508) | 17.229 (11.496) | 17.939 (11.496) | 9,983 (9.987) | 17.939 (12.030) |
| $Age^2$ | -23.791 (13.925*) | -23.780 (13.905*) | -24.365 (13.905*) | -14,725 (12.342) | -24.365 (14.208*) |
| Educ | 6.444 (2.644***) | 6.413 (2.648***) | 6.520 (2.648***) | 5,511 (2.086***) | 2.094 (0.993***) |
| $Educ^2$ | -0.583 (0.685***) | -0.578 (0.0.685***) | -0.58 (0.0.685***) | -0,144 (0.556) | -0.050 (0.081***) |
| age*educ | -25.151 (11.178***) | -25.033 (0.074***) | -25.663 (11.194***) | -26,073 (8.666***) | -8.580 (4.246***) |
| $age^2$*educ | 26.226 (12.303**) | 26.160 (12.303**) | 26.885 (12.303**) | 30,883 (9.837***) | 9.267 (4.493**) |
| age*$educ^2$ | 0.946 (1.804) | 0.935 (1.809) | 0.932 (1.809) | 0,082 (1.436) | 0.084 (0.218) |
| CHILD0 (Réf.) | - | - | - | - | - |
| CHILD1 | 0.025 (0.133) | 0.028 (0.133) | 0.03 (0.133) | 0,102 (0.104) | 0.025 (0.137) |
| CHILD2 | 0.229 (0.131) | 0.229 (0.131) | 0.228 (0.131) | 0,490 (0.107***) | 0.236 (0.129) |
| CHILD3 | -0.087 (0.140) | -0.089 (0.149) | -0.087 (0.149) | -0,563 (0.173***) | -0.070 (0.141) |
| YOUNGCHILD1 | -0.090 (0.205) | -0.087 (0.205) | -0.096 (0.205) | -0,075 (0.156) | -0.066 (0.219) |
| YOUNGCHILD2 | -1.113 (0.198***) | -1.110 (0.198***) | -1.112 (0.198***) | -0,452 (0.252) | -1.099 (0.199***) |
| YOUNGCHILD3 | -0.905 (0.188***) | -0.905 (0.019***) | -0.895 (0.019***) | -0,032 (0.265) | -0.885 (0.184***) |
| Paris area | -0.099 (0.115) | -0.077 (0.108) | -0.061 (0.114) | -0.080 (0.096) | -0,068 |
| URV | -0.523 (0.966) | | | 1.224 (0.971) | |
| Constant | -2.523 (2.567***) | -2.636 (2.561***) | -2.649 (2.572***) | -2.34 (2.170) | -2.649 (2.955***) |
| rho | | | | 0,758*** | - |
| rho11 | | | | - | -0,113 |
| rho23 | | | | - | -0,014 |
| rho13 | | | | - | -0,256*** |
| N | 2171 | | | 10525 | 2171 |
| ln L | -801.767 | -801.742 | -802.601 | -5344.090 | -2793.101 |
| pseudo $R^2$ | 0.149 | 0.149 | 0.148 | 0.021 | 0.042 |

Estimate * at the 10% level of significance, ** at the 5% level, *** at the 1% with White's correction

In the univariate probit model, the variable $WTR35$ is positive and significant. On the other hand variables $WTR39$ and $WTR35$ are not significant.

The estimates taking account the selection bias allows to partly control the unobserved characteristics associated to the decision to join the labour market. In that case, an added worker effect remains positive and significant for the variable ($WTR35$), when spouse works 35 hours a week in a company which signed a WTR agreement.

Lastly, when the spouse's situation regarding working time reduction and the situation of his (her) firm are endogeneised and estimated simultaneously with the probability to join the labour market, the added worker effect ($WTR35$) remains positive and significant.

Concerning the impact of the unemployment rate variation per department and per sex between 1999 and 2000 ($URV$) and the logarithm of the spouse's wage ($SLW$), several estimations are carried on. The variable $URV$ does not affect the individual's professional decision, and its omission does not seem to influence the significance of the other coefficients of the model. The spouse's logarithm wage ($SLW$) is significant and affects negatively the decision to join the labour market. The higher the spouse's income is, the less encouraged the individual is to join the labour market. This match the assumption according to which leisure is a normal good.

In order to control a possible problem of endogeneity, spouse's logarithm wage is estimated using instrumental variables: a dummy variable on the geographical location and by a quadratic relation of age, education level, and spouse's experience. In this specification, so as to get non biased term of error, the variance and covariance matrix is corrected according to the standard correction.

Table 1.5. presents the results of marginal effects associated to the situation of one's spouse regarding to working time reduction to 35 hours a week ($WTR35$, $WTR39$, $NWTR35$), to the unemployment rate variation ($URV$) and to the spouse's wage ($SLW$). This table allows us to compare the results obtained in different specifications.

The marginal effect of one's spouse's situation regarding to working time reduction to 35 hours a week on one's decision to enter the working population varies between **+0,06** and **+0,08**. Models (1) and (6) presents the results we got with the multivariate probit model taking account of the selection bias including unemployment rate variation (model 1 and 4) excluding this variable (model (1) and (5)) and using the spouse's wage (model (3) and (6)). Taking in account the selection bias tends to strengthen the added worker

Table 1.5 : Marginal effects

| Variables | | WTR35 | WTR39 | NWTR35 | SLW direct | SLW IV | URV |
|---|---|---|---|---|---|---|---|
| Probit univarié | | | | | | | |
| (1) | coefficient | 0.297 | $0.038^{ns}$ | $-0.016^{ns}$ | -0.213 | - | $-0.523^{ns}$ |
| | marginal effect | 0.068 | 0.007 | -0.003 | -0.044 | | -0.107 |
| (2) | coefficient | 0.297 | $0.039^{ns}$ | $-0.018^{ns}$ | -0.210 | | |
| | marginal effect | 0.068 | 0.008 | -0.004 | -0.043 | | |
| (3) | coefficient | 0.307 | $0.034^{ns}$ | $-0.011^{ns}$ | | -0.222 | |
| | marginal effect | 0.071 | 0.007 | -0.0002 | | -0.045 | |
| Probit bivarié | | | | | | | |
| (4) | coefficient | 0.232 | $0.033^{ns}$ | $-0.007^{ns}$ | -0.166 | | 1.224 |
| | marginal effect | 0.086 | 0.009 | 0.000 | -0.054 | | 0.665 |
| (5) | coefficient | 0.273 | $0.036^{ns}$ | $-0.011^{ns}$ | -0.199 | | |
| | marginal effect | 0.087 | 0.009 | 0.0003 | -0.054 | | |
| (6) | coefficient | 0.289 | $0.032^{ns}$ | $0.004^{ns}$ | | -0.209 | |
| | marginal effect | 0.085 | 0.009 | 0.001 | | -0.056 | |

effect associated to the 35 hours. Thus the added worker effect is associated to the working time reduction is positive and significant. The fact remains that the magnitude of this effect is limited compared to the other coefficients of the model.

# 5 Conclusion

The 35 hours legal weekly working time legislation affects the labour supply of full time employees. Beyond this direct effect, it can also influence decisions of non-working population, unemployed and part-time employees through family labour supply interactions. This paper expands on the conventional added worker effect in order to analyse successively the effect of the 35 hours week on two dimensions of the partner's labour supply: the number of hours worked and the probability to participate in the labour market. Econometric tests are carried out on 10 000 couples drawn from the French EMPLOYMENT survey of the INSEE. In the first estimation using Heckman's framework and Cogan's fixed costs framework, I found that one's working time reduction reduces his (her) spouse's working hours when he (she) works. Thus, it seems that complementary effect of leisure dominate the substitution effect of domestic production between spouses. In the second estimation, using multivariate probit framework, I can state that when the spouse was outside of the labour market in the previous period, the WTR increases her probability to join the labour market. This effect remains positive and significant even when controlling unobserved characteristics. These

results on French data seem to be consistent with those of Hunt [1998] on German data. However, this paper used longitudinal data with lagged information. Further studies using panel data are necessary to confirm these first results.

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